

POTENTIAL CAUSES OF INCREASED LAKE PHOSPHOROUS

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Introduction

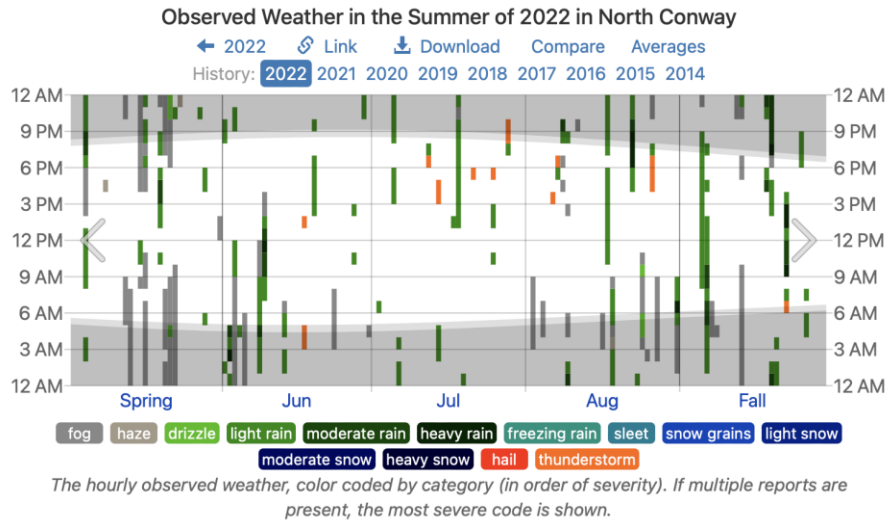
This article is intended to supplement the CLCA 2023 Newsletter article on Water Quality. As reported in the newsletter, we detected a significant increase in Lake water phosphorous during the UNH testing carried out on August 15, 2022, and want to understand the cause of the increase and, if possible, mitigation steps. In the Newsletter article we stated that the most likely cause of the increase might be excessive shorefront development with violations to the Town of Conway's shorefront protection regulations.

Our UNH partners who have supported our Lake water testing for the last 40 years have suggested there are five potential sources for the increase, and we discuss each in the paragraphs below.

Weather

Lake phosphorous could see an increase if there were exceptionally high amounts of rainfall prior to the testing date of August 15, 2022. We investigated the weather history for the North Conway area for the summer of 2022 and found that the rainfall in July and the first half of August was abnormally low and discount that cause as a contributor.

The source of our weather data is from Weatherspark.com, a service of Cedar Lake Ventures, Inc. in Excelsior, MN 55331. Inquiries are best by email at support@weatherspark.com. The average rainfall in the months of July and August for North Conway is about 3.5 inches per month or just over 5 inches for the six weeks prior to the August 15th testing. The actual rainfall was less than 2 inches for that time period and weatherspark's data for the period is shown below.



Lake Bottom Churning

Lakes such as ours evolve to fill in over the very long term as the inflows and outflows do not "wash out" the annual sediment that settles to the bottom. The bottom sediment of the Lake is rich in nutrients from various sources, much of which is the vegetative material that flows into the Lake from its tributaries. If this bottom layer of sediment were to be disturbed significantly and mixed with the rest of the Lake water, the levels of nutrients would be higher and the water would not be nearly as clear as it is. Fortunately, the Lake is deep enough to resist any significant churning from boating or storms and naturally forming thermoclines persist to keep the bottom sediment on the bottom.

During the UNH testing of August 15, 2022 at Gull Rock that showed the Lake phosphorous to be 8.3 ppb, the very bottom of the Lake was also tested and that result was 6.5 ppb. It seems apparent that the Lake bottom sediment at Gull Rock had not been churned significantly and this source of the increased phosphorous for the Lake is discounted.

Tributaries

Conway Lake has 14 primary tributaries that feed water, and phosphorous, into the Lake. As discussed in the Newsletter, the average levels of phosphorous in our streams has decreased over the last three years and for that fact alone, we discount the tributaries as causing the one year jump in Lake phosphorous. We looked further into the individual streams to make sure that it was not one or two streams that may have been abnormally high and could be a partial contributor.

The 14 streams have a wide variety of flow rates depending upon their catchment area (or terrain they drain) and elevation. The east side streams drain much steeper terrain than the west side and have fast flow rates and often much greater volumes of water. We took the four

highest flow rate streams (Snow, Clarke, Baird and Wiley) and checked on the phosphorous readings for those streams as shown in the table below.

CONWAY LAKE HI FLOW RATE TRIBUTARY PHOSPHOROUS

Stream	Spring 2020	Fall 2020	Spring 2021	Fall 2021	Spring 2022	Fall 2022
Snow	6.9	17.8	11.9	15.7	82	10.5
Clarke	7.0	26.7	5.6	12.1	6.1	11.4
Baird	25.2	29.6	8.0	12.7	8.0	10.1
Wiley	8.7	15.0	13.2	11.5	14.7	12.6
AVE	12.0	22.3	9.7	13.0	27.7	11.2

The phosphorous levels for these streams, on average, have decreased significantly each year and we have discounted the tributaries as being a cause of the increase in Lake phosphorous.

It should be noted that the stream phosphorous readings are significantly higher than the Lake levels and this is expected as the streams are washing recent vegetative material into the Lake and this material is rich in nutrients. The phosphorous becomes diluted in the massively larger volume of Lake water and much of it gradually settles out to the bottom of the Lake.

Failed Septic Sytems.

Our Lake has many shorefront properties that were constructed over the last century and many of the older homes have rudimentary septic systems that could be overwhelmed and leak into the Lake. Any surface leakage would be readily apparent to owners or to shoreline boaters and would quickly raise alarms. We have not seen any evidence that this has occurred and certainly not on a wide spread basis which would be necessary to quickly drive up the Lake phosphorus level to what was detected last summer.

We also have our AIS patrollers who routinely study the entire shoreline over the summer and nearly all the populated areas are patrolled several times. On one occasion last summer there was one suspicious smelling and appearing surface layer that was reported to DES who came out and tested the water and found it not to be from a failed septic system. This particular suspicious contaminant was never identified and dissipated within a few days.

Leaky septic systems might also enter the Lake under the surface and not be readily apparent. However, there would need to be a large number of these undersurface leakage systems to spring up all at the same time to double the phosphorous in the middle of the Lake (Gull Rock).

For these reasons, we have discounted failed septic systems as an immediate cause, although this source could be a contributor and could escalate into a major source in the longer term.

Shorefront Protection Violations

As indicated in the Newsletter, many of us have noticed several new or remodeled homes on the western shore that have been constructed recently. It is obvious in some cases that the shorelines have had excessive large trees cut down, underbrush and native shrubbery removed and human amenities installed. Such activity eliminates the natural filtering of rainwater and snowmelt as well as waste water from homes and may be the leading cause of increased Lake level phosphorous.